Affording Defense Capability: An SE-Centric Take on Science and Technology Priorities

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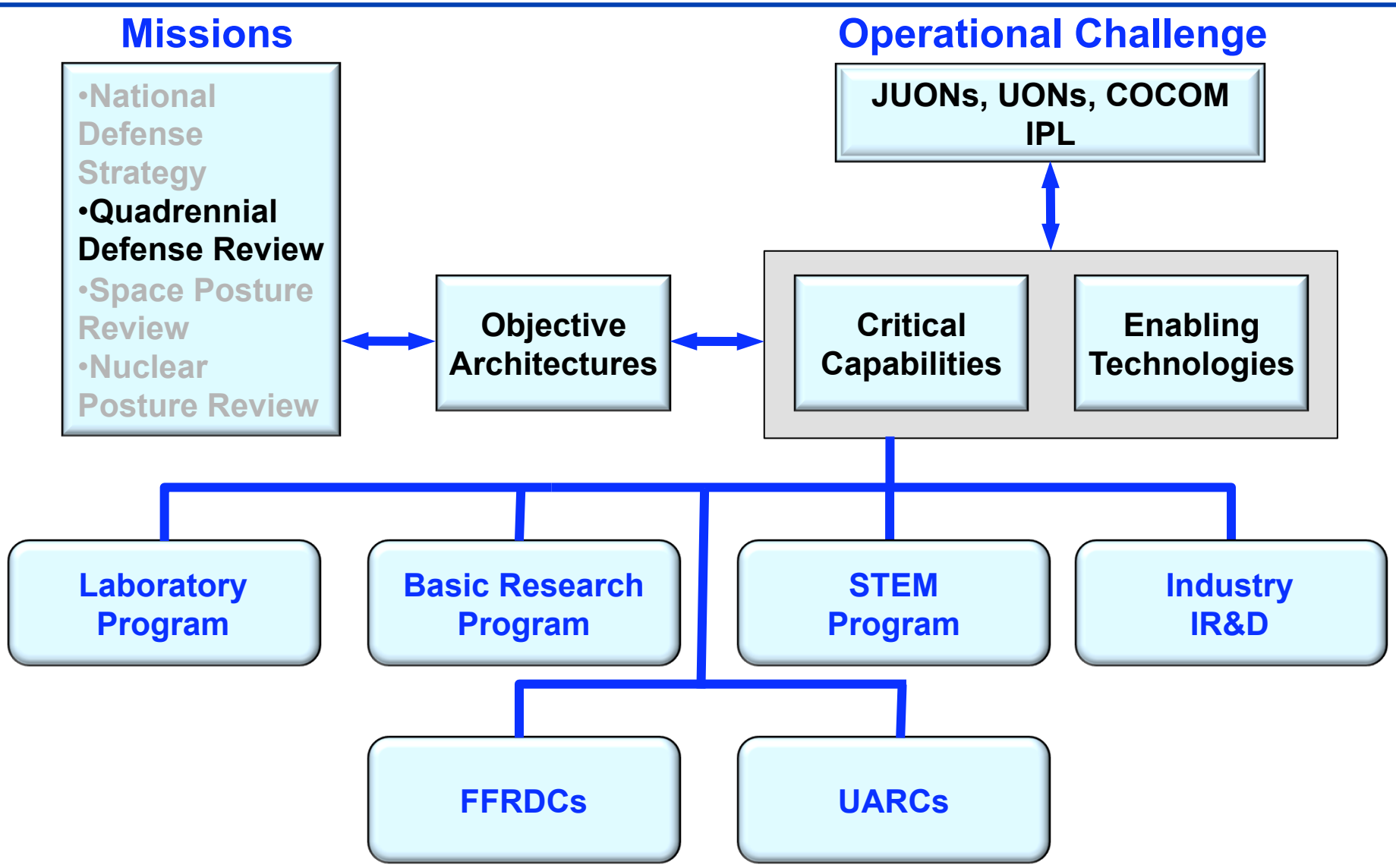
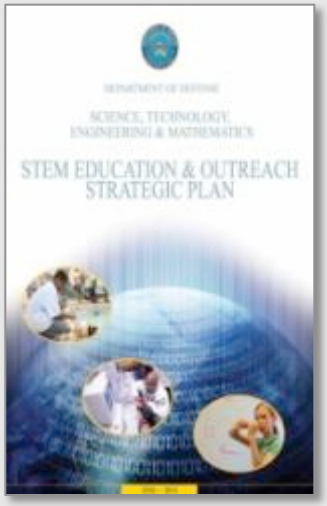
Integrated S&T Enterprise

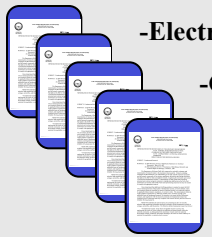


Assistant Secretary of Defense Research and Engineering Imperatives

1. Accelerate delivery of technical capabilities to win the current fight.
2. Prepare for an uncertain future.
3. Reduce the cost, acquisition time and risk of our major defense acquisition programs.
4. Develop world class science, technology, engineering, and mathematics capabilities for the DoD and the Nation.



Fast Track Studies

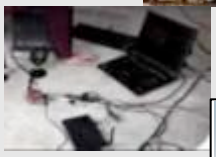


-Electronic Warfare
-Computer Science
-Cyber Operations
-Energy & Water
-Rapid Capability Tool Kit

Task Forces

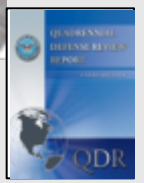
Helo Survivability

Base Protection



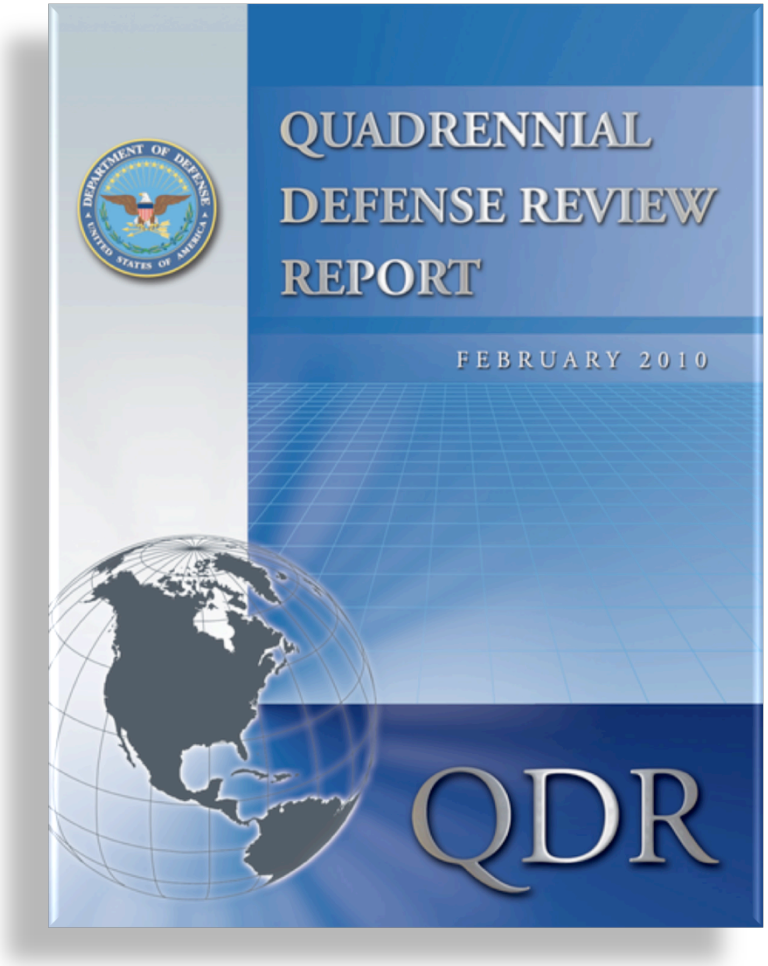
Tag, Track, Locate

C-IED SIG Support



QDR Missions Architectures

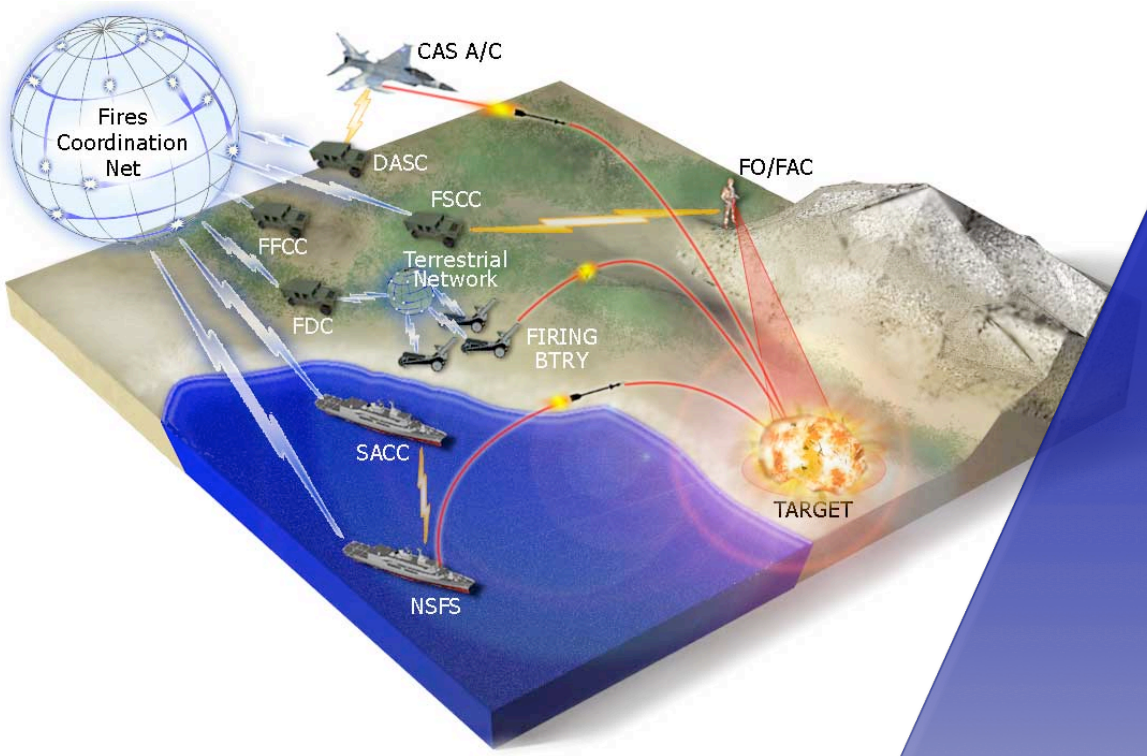
Quadrennial Defense Review Mission Set

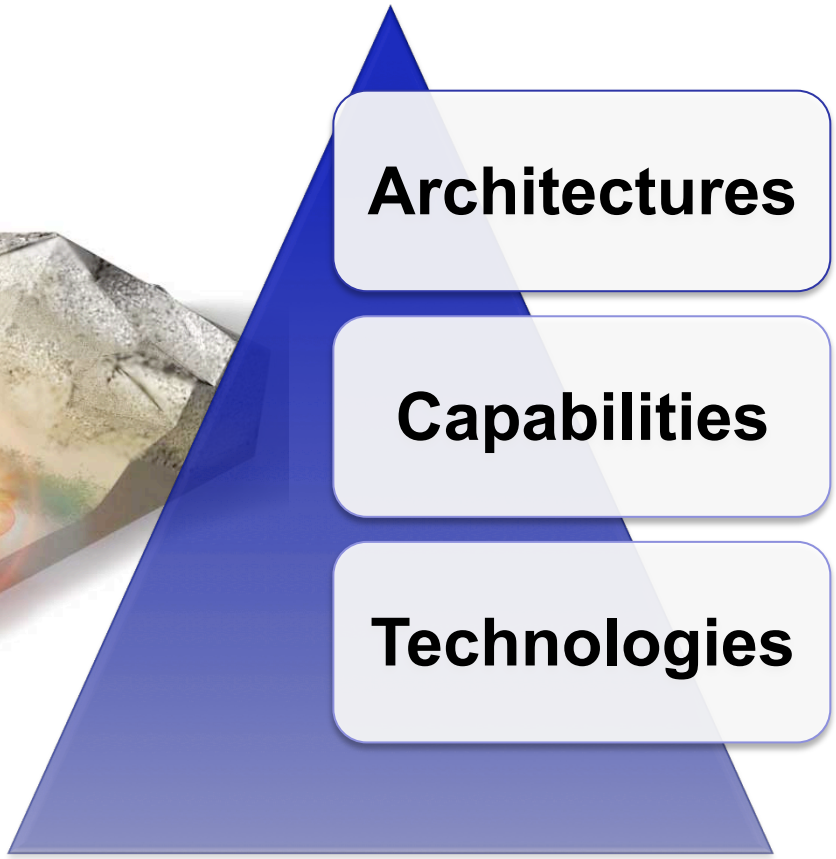


1. Defend the United States and Support Civil Authorities at Home
2. Succeed in Counterinsurgency, Stability, and Counterterrorist Operations
3. Build the Security Capacity of Partner States
4. Deter and Defeat Aggression in Anti-Access Environments
5. Prevent Proliferation and Counter Weapons of Mass Destruction
6. Operate Effectively in Cyberspace.

http://www.defense.gov/DefenseReviews/

Architecture – Technology Trade Space

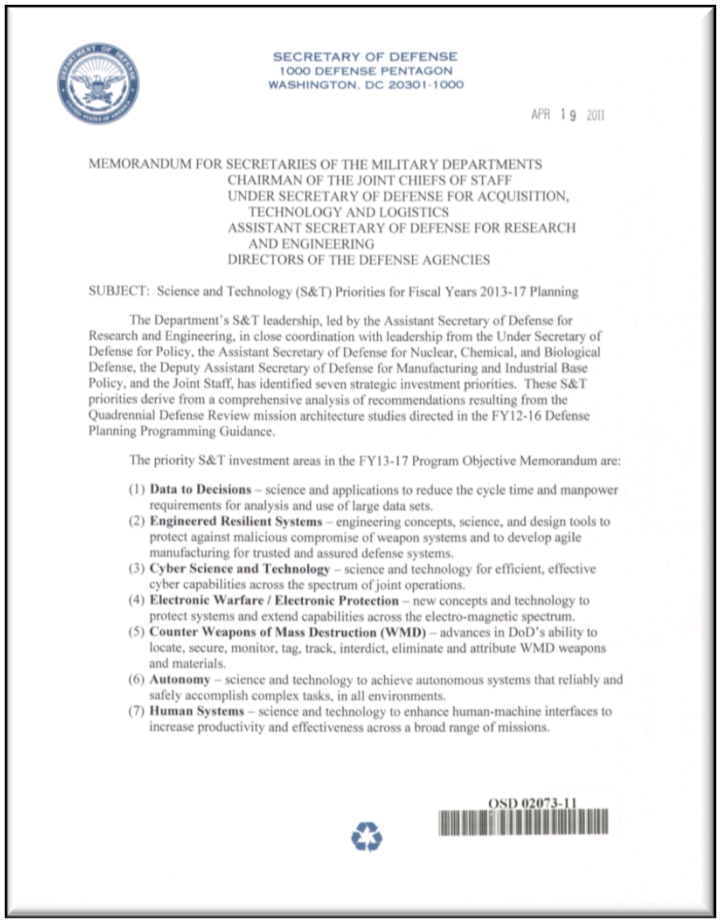




Architectures Drive Technologies
Technologies Inform Architectures

DoD S&T Focus Areas

SECDEF Guidance



SECRETARY OF DEFENSE
1000 DEFENSE PENTAGON
WASHINGTON, DC 20301-1000

APR 19 2011

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS
CHAIRMAN OF THE JOINT CHIEFS OF STAFF
UNDER SECRETARY OF DEFENSE FOR ACQUISITION, TECHNOLOGY AND LOGISTICS
ASSISTANT SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING
DIRECTORS OF THE DEFENSE AGENCIES

SUBJECT: Science and Technology (S&T) Priorities for Fiscal Years 2013-17 Planning

The Department's S&T leadership, led by the Assistant Secretary of Defense for Research and Engineering, in close coordination with leadership from the Under Secretary of Defense for Policy, the Assistant Secretary of Defense for Nuclear, Chemical, and Biological Defense, the Deputy Assistant Secretary of Defense for Manufacturing and Industrial Base Policy, and the Joint Staff, has identified seven strategic investment priorities. These S&T priorities derive from a comprehensive analysis of recommendations resulting from the Quadrennial Defense Review mission architecture studies directed in the FY12-16 Defense Planning Programming Guidance.

The priority S&T investment areas in the FY13-17 Program Objective Memorandum are:

(1) **Data to Decisions** – science and applications to reduce the cycle time and manpower requirements for analysis and use of large data sets.
(2) **Engineered Resilient Systems** – engineering concepts, science, and design tools to protect against malicious compromise of weapon systems and to develop agile manufacturing for trusted and assured defense systems.
(3) **Cyber Science and Technology** – science and technology for efficient, effective cyber capabilities across the spectrum of joint operations.
(4) **Electronic Warfare / Electronic Protection** – new concepts and technology to protect systems and extend capabilities across the electro-magnetic spectrum.
(5) **Counter Weapons of Mass Destruction (WMD)** – advances in DoD's ability to locate, secure, monitor, tag, track, interdict, eliminate and attribute WMD weapons and materials.
(6) **Autonomy** – science and technology to achieve autonomous systems that reliably and safely accomplish complex tasks, in all environments.
(7) **Human Systems** – science and technology to enhance human-machine interfaces to increase productivity and effectiveness across a broad range of missions.

OSD 02073-11

19 April 2011

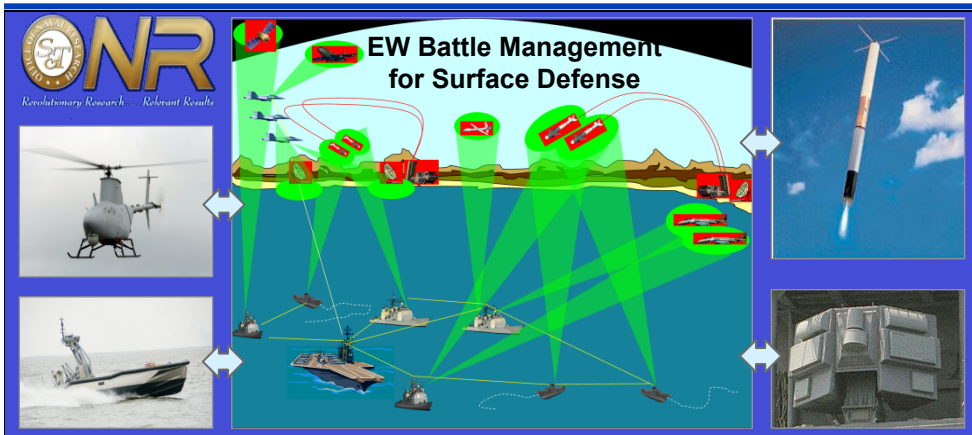
Complex Threats

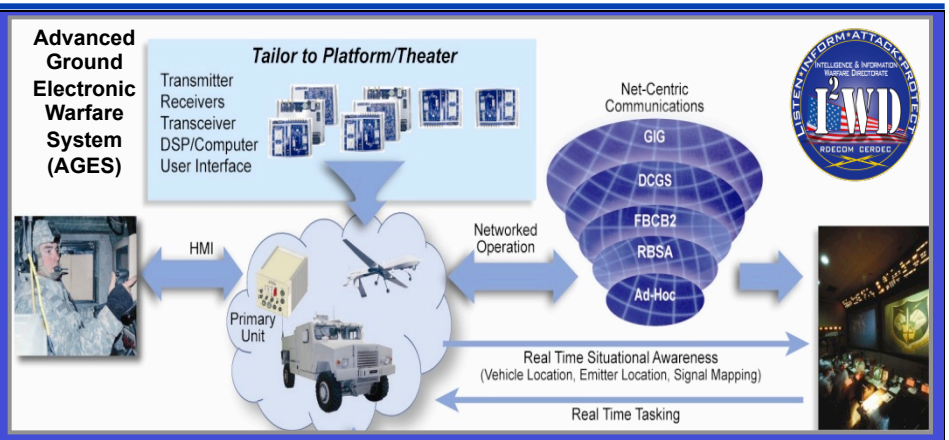
- Electronic Warfare / Electronic Protection
- Cyber Science and Technology
- Counter Weapons of Mass Destruction

Force Multipliers

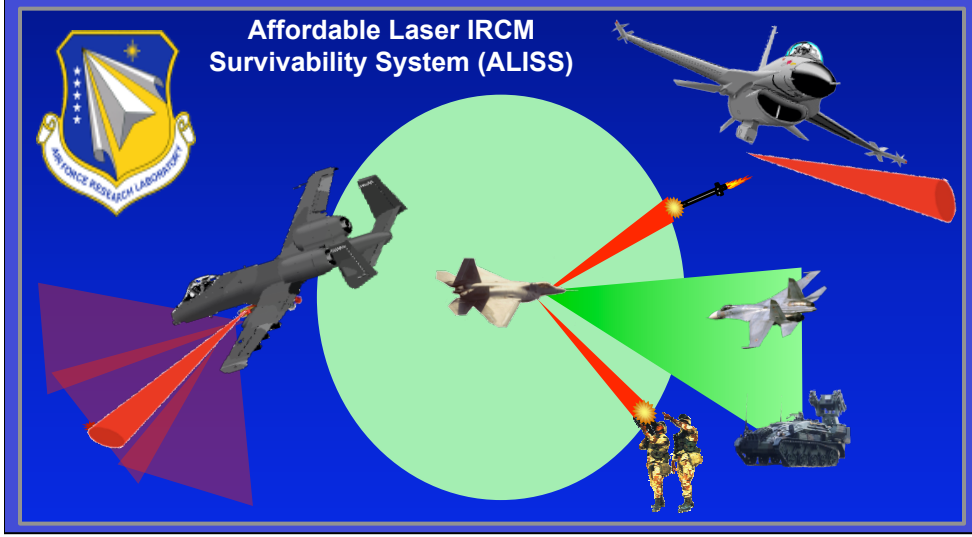
- Data-to-Decisions
- Human Systems
- Autonomy
- Engineered Resilient Systems

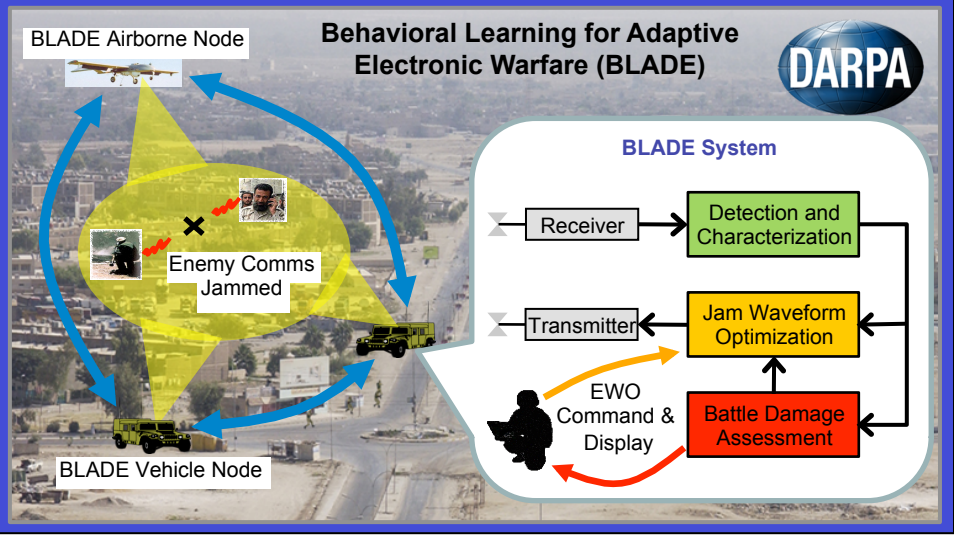
Electronic Warfare / Electronic Protection



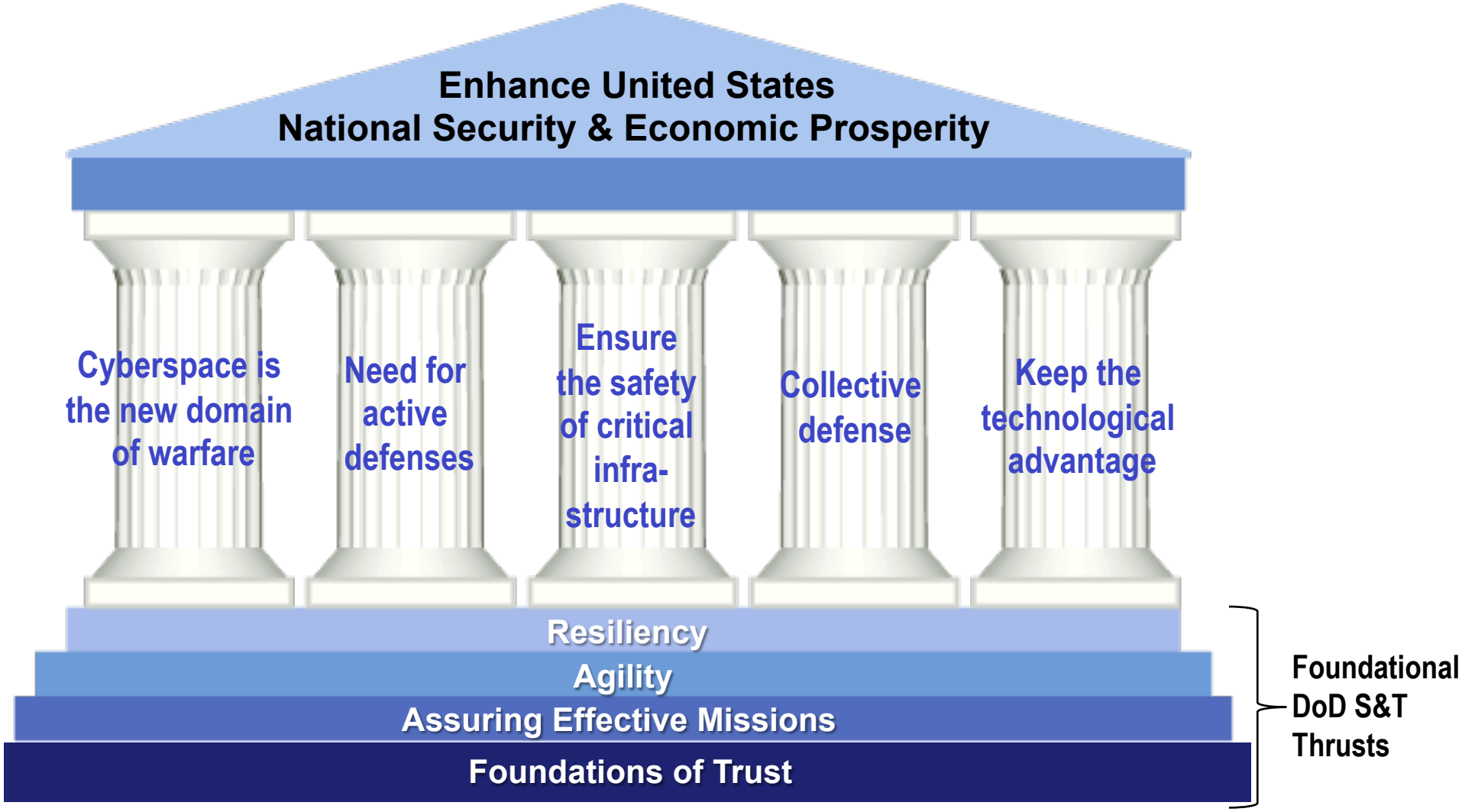


New capabilities to dominate the electromagnetic spectrum





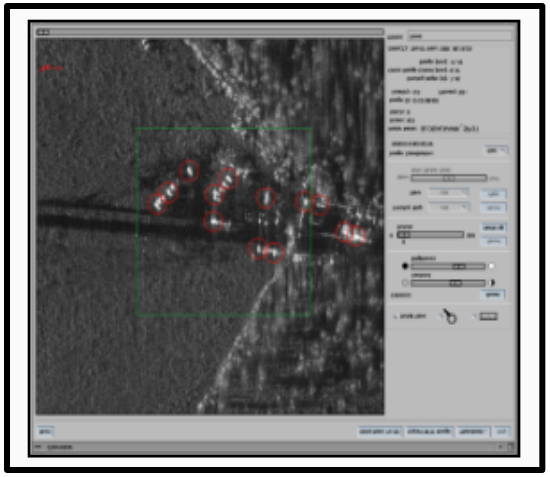
Cyber: Architecture for S&T Investments



Countering Weapons of Mass Destruction

- **Advanced sensors**
- **Rapid response capabilities**
- **Advanced defeat mechanisms**

Data-to-Decisions

Data Management Layer	Analytics Layer	User Interaction Layer
		

- **Investments span all aspects of this challenge with emphasis shifting from imagery to motion and text analytics**
- **Unstructured data analytics is the most challenging and critical component**

Human Systems

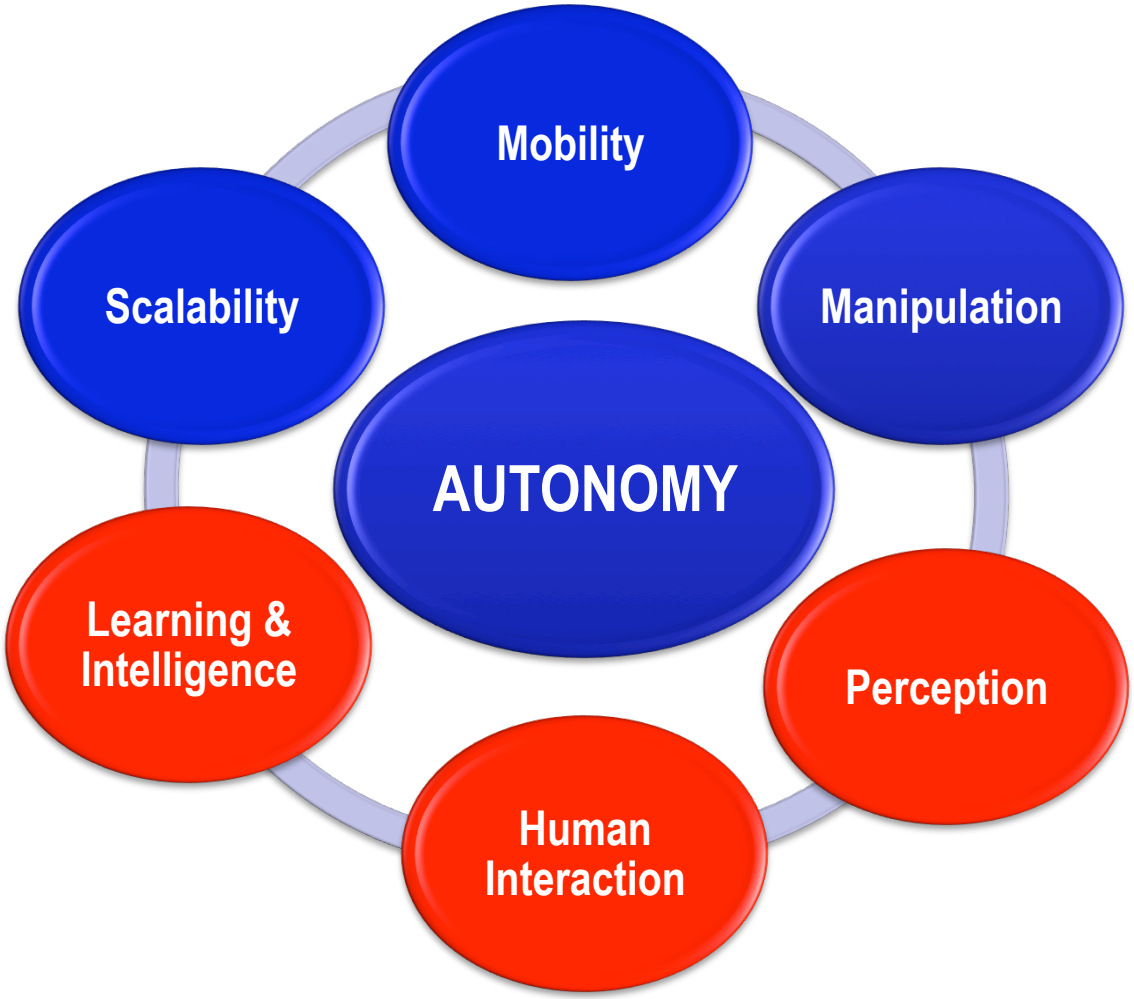
Personnel & Training

- Realistic, immersive training
- Adaptive, tailored instruction
- Train partner state forces

Strategic Decision Support

- Battle management
- Autonomous system control

Autonomy



Engineered Resilient Systems
Complex Systems Design

Trustworthy Systems Design

Conceptual Engineering

Technical Thrusts

Trustability: design patterns, analytic tools

Tying design, physical and computational testing

Virtual worlds projecting alternative futures

Model-based tools: Analysis and simulation

Tradespace exploration

Platform-based analysis and architecting

Model Based Engineering

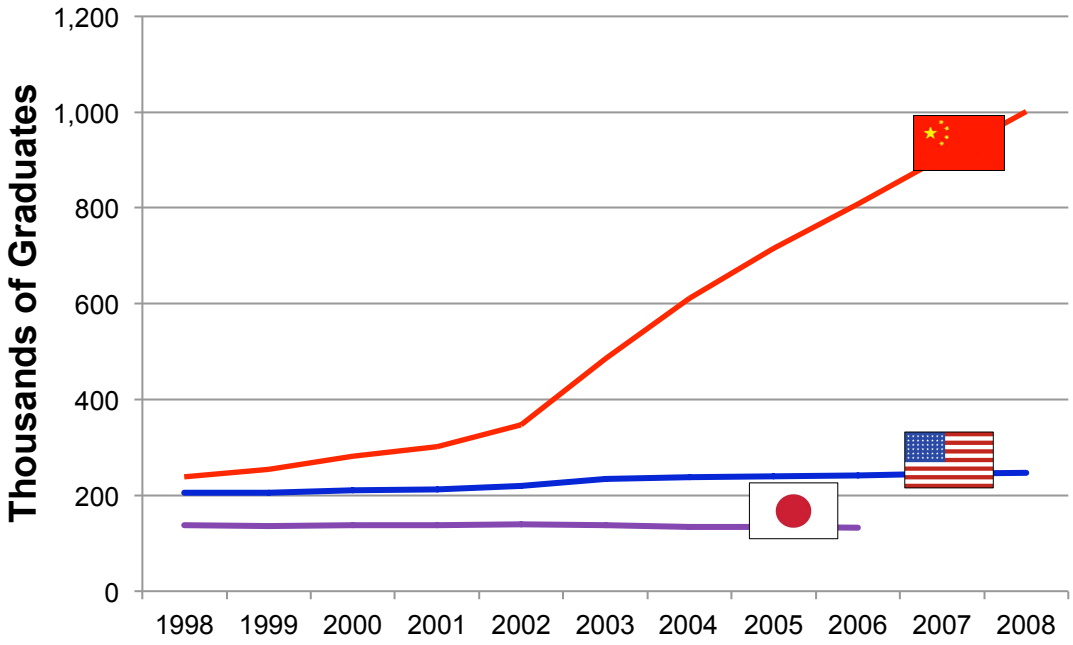
Platform Based Engineering

Some Final Thoughts

- **How will we get there?**
- **Systems Engineering Research can contribute to many of the cross cutting DoD S&T priorities**
  - We are placing priority for the SERC on Engineered Resilient Systems
  - Today's panel will kick this off!

And, while you're at it…

First Degrees in Natural Sciences and Engineering by Country



Source: National Science Board, S&E Indicators, 2010; SDO Analysis

Give us the workforce we need to execute in the 21st Century!